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ABSTRACT

Eighteen teachers of primary through secondary level educable mentally retarded students participated in an experiment to measure the science skills and concepts achieved through a slightly modified program designed for normal elementary students. Teachers were randomly divided into two experimental groups: the psychomotor group employing such Elementary Science Study (ESS) tasks as primary balancing and mystery powders, or the perceptual group focusing on such ESS units as pattern blocks, mirror-cards, and tracks. Students' science skills of communicating, observing, and inferring were measured on a subtest of the Illinois Test of Psycholinguistic Abilities. Results indicated that except for the intermediate level control group, the experimental groups in all levels made higher scores on all three science skills than a control group. (CL)

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MESSING AROUND WITH EMR'S

A Paper

Presented to The

54th Annual International Convention

The Council for Exceptional Children

Chicago, Illinois

April 8, 1976

by

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Introduction

How can you teach science to handicapped children, especially the mentally retarded? This question has been asked for many years. The answers most often given are, "You can't," "Science is too hard for them," "They don't understand it." In view of some encouraging research on teaching science to the handicapped, the above answers are simply not true. Science as a content area is not too difficult for the mentally retarded. In fact, it is absolutely necessary if these children are to survive in the "scientific age" (Bennett and Downing, 1971).

Because we care for each person as an individual; because all children, regardless of a thing called IQ, have the same needs, hurts, aspirations for a future, and joys; because we refuse to believe that being mentally retarded means being sub-human, destructive, criminally dangerous or insane; because we have dared to hope for a better today to take a risk on the untapped potential in retarded children; because we will not allow the myth, "nothing can be done for these kind of children," to trap us into negligence or apathy; because we feel so strongly that retarded children are not always, nor do they need be, an insufferable burden to the family and society; because we believe that all children have the right to take pride in accomplishment for newly developed skills no matter how long it takes to learn, how simple the skill, how costly the innovation; because we believe that overprotection from the environment as the result of a handicap does not help children, but hinders their expansion of potential and sense of accomplishment in surmounting a hardship; because all of us, no matter how "normal," have limits and special needs; ... we have embarked on the trail to facilitate the teaching of science to the mentally retarded.

Some Relevant Research

A study by Katz (1964) showed that handicapped children could learn scientific material, and that they could apply the knowledge they acquired in subsequent problem-solving situations. Another study (Bennett and Downing, 1971) indicated that science helps to establish desirable work habits and trains the mentally handicapped to cope with daily life experiences. Shulene conducted a study involving forty-five EMH children, ages 7-16 years, using an inquiry approach with pictorial riddles to teach selected science concepts. He concluded: 1) significant learning did take place, and 2) the pictorial riddle approach is an effective method of helping EMH students develop scientific concepts through inquiry (Shulene, 1972; 1975).

Boekel and Bybee (1973) reported results of an increase in attention span, greater awareness of the environment, an improvement of short-term memory skills, and the ability to predict future events as well as recalling the past with EMH students ages 7-10 years. These students were exposed to specific units of Science Curriculum Improvement Study (SCIS). They were then asked to solve selected Piagetian tasks by the co-authors. Thompson (1974) experimented with eleven EMH students (ages 8-12 years) on developing basic concepts of magnetism and electricity. He concluded: 1) they could often demonstrate science concepts if they could not verbalize, and 2) they did understand what electricity can do and why it must be respected. In using Science - A Process Approach (S-APA) materials with disadvantaged children, Huff and Languis (1973) concluded science experiences were effective in developing oral language skills with particular strength indicated for transmitting speaking skill competencies. Wilson and Koran (1973) used S-APA materials with eleven special education students ages 12-14 years. The

trained teachers modified the materials as needed for an individually prescribed program. The authors concluded, "Ample varieties and quantities of concrete objects aid in developing communication skills..." (p. 31).

The Biological Sciences Curriculum Study (BSCS), with funding from USOE/BEH, has developed science curricula for the Educable Mentally Handicapped. ME NOW, a life science curriculum, is on the commercial market for EMH students 11-13 years. ME AND MY ENVIRONMENT, an environmental sciences curriculum, has four units completed and on the commercial market with the remaining unit in final paste-up ready to go to the publisher yet this month. All five units will be ready to purchase for Fall 1976. A new project, ME IN THE FUTURE, aims to develop a broad spectrum of science concepts and skills that will expand career opportunities related to vocations, leisure time activities, and personal living skills. This curriculum is being produced for the EMH student 15-19 years of age. Anticipated completion is scheduled for Summer 1979. Evaluation of ME NOW and ME AND MY ENVIRONMENT has shown that EMH children can succeed in science programs, that they are interested in science, that science can aid in development of problem-solving skills, and that such programs can help meet the physical, psychological, and social needs of these children (Mayer, 1975).

So, science--a field previously considered out of bounds for the mentally retarded student--is a discipline which can offer opportunities for special children as they develop into independent citizens.

Research Project

During the summers of 1974 and 1975, two two-week workshops were funded by the National Science Foundation at Ball State University for the purposes of adapting and implementing the Elementary Science Study (ESS) for use with

handicapped children (Ball, 1975). Eighteen teachers and administrators from the Northwest Indiana Special Education Cooperative in Lake County, Indiana, were invited to BSU in August, 1974, for a workshop in science for the handicapped. The summer 1975 workshop was for teachers and administrators from Delaware County, Indiana, Special Education Cooperative.

The participants were teachers of students labeled learning disabled, physically handicapped, educable mentally retarded, trainable mentally retarded, and emotionally disturbed. Each participant chose two or three ESS units to study in depth, prepare lessons, teach the other participants, and evaluate the effectiveness their units might have with "special" students. They also evaluated the demonstrated units, and made suggestions for adaptations that could increase their effectiveness for particular types of students. The administrators, including Supervisors of Special Education, Science Supervisors, and the Directors of Special Education, engaged in the same activities as the teachers.

The EMR teachers of the Northwest Indiana Cooperative agreed to participate in a research study during the school year 1974-75. They were randomly selected and placed into one of three groups--two experimental groups and one control group. One experimental group consisted of nine teachers and their classrooms using the following ESS units: PRIMARY BALANCING, SINK OR FLOAT, CLAY BOATS, MYSTERY POWDERS, ICE CUBES, and BATTERIES AND BULBS. This group was labeled the Psychomotor Group due to the "psychomotor" nature of the units.

The Perceptual Experimental Group consisted of nine teachers and their classrooms using the following ESS units: PATTERN BLOCKS, GEO-BLOCKS, TANGRAMS, ATTRIBUTE GAMES AND PROBLEMS, MIRROR CARDS, and TRACKS. These units are particularly attuned to perception, hence the name Perceptual Group. The

control group consisted of eight teachers and their classrooms not using ESS materials, but nevertheless science was being taught in the teachers' modes.

For the purposes of measuring the science skills of communicating, observing, and inferring the EMR students in the above study were administered the Modified Verbal Expression Sub-test of the Illinois Test of Psycholinquistic Abilities (ITPA). The Verbal Expression Sub-test consists of statements made by the students about four familiar objects: a ball, a block, an envelope, and a button. They are tallied by categories such as: 1) color, 2) use, 3) numerosity, 4) shape, etc. The Modified portion consisted of an additional two columns for tallying direct observations and inferences made about the objects. Statistical analyses were computed on the basis of these three scores. We found for the Primary level:

1) ESS units do equally as well as traditional modes in developing the three science skills of observing, inferring, and communicating.

2) If a school system is using ESS at the Primary level, it would appear the Psychomotor units would be preferred.

We found for the Intermediate level:

1) All of the above ESS units are appropriate.

2) The Perceptual units better develop the science skills of observing and communicating, while the Psychomotor units increase inference skills.

We found for the Junior High level:

1) Exposure to ESS units increases inference skills.

2) The Perceptual units appear more applicable than the Psychomotor units.

We found for the Senior High level:

1) ESS units are educationally appropriate and may be preferable to traditional modes of science.

2) Either Perceptual or Psychomotor ESS units may be used with varying degrees of effectiveness in developing the three science skills.

Except for the Intermediate age control group, which showed an increase in inference, the Experimental groups in all levels made higher scores on all three science skills (observation, inference, and communication) than the control group.

Summary

Educable Mentally Retarded students can develop science skills and concepts utilizing a science program designed for "normal" elementary students with slight modification where needed (Mansfield, 1976). The Elementary Science Study contains numerous units appropriate for use with mentally retarded children. Those units used in this study are summarized below.

ESS UNITS RECOMMENDED FOR EDUCABLE MENTALLY RETARDED CHILDREN

Tested and Recommended

Perceptual Units

1. Pattern Blocks
2. Geo-Blocks
3. Tangrams
4. Attribute Games & Problems
5. Mirror Cards
6. Tracks

Psychomotor Units

1. Primary Balancing
2. Sink or Float
3. Clay Boats
4. Mystery Powders
5. Ice Cubes
6. Batteries & Bulbs

Not Statistically Tested but Recommended

1. Mobiles
2. Mapping
3. Brine Shrimp
4. Drops, Streams, Containers
5. Butterflies
6. Peas and Particles
7. The Life of Beans & Peas
8. Match & Measure
9. Light & Shadows
10. Structures
11. Small Things
12. Colored Solutions
13. Changes
14. Behavior of Mealworms
15. Musical Instrument Recipe Book
16. Earthworms
17. Starting from Seeds

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